

ARTERIOVENOUS ANASTOMOSIS FOR GANGRENE.

THE REPORT OF A THIRD CASE.

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CATHERINE C., 84 years old, entered the Boston City Hospital on November 23, 1907, with the following history:

One year ago a sore appeared on the anterior part of the right ankle which was treated with applications of mutton tallow and alcohol. The skin came off and an ulcer resulted. The foot became swollen, tender and painful. For the last three weeks these conditions have been becoming worse so that sleep is prevented.

The big toe was found to be in a condition of dry gangrene with moist gangrene of three other toes and a portion of the dorsum of the foot.

The urine was high, 1020, acid, free from albumin and sugar.

On December 5 the thigh was amputated at the junction of the middle and lower thirds by Dr. F. B. Lund. The pathological report states that the vessels were arteriosclerotic.

A bed-sore developed, but the patient was discharged on January 20 with sore and stump healed.

On March 14, 1908, she re-entered the hospital and stated that about the middle of February a "bed-sore" came on the left heel. The sore had been growing larger and more tender, especially rapidly during the last few weeks.

Examination at this time showed a very thin garrulous old woman of fair development. Lungs: in backs many moist râles, slight dulness. Heart: no murmurs, regular in rate and force. Right leg amputated above the knee. Left leg normal, except for local condition. Cataract in right eye. Left heel presents on posterior under aspect an area $2\frac{1}{2}$ inches in circumference in which the skin and underlying tis-

sues are necrotic. The foot was said to have been cold, but how far up the cool area extended is not known. Urine: pale, 1020, acid, free from albumin and sugar.

On March 23 under ether an arteriovenous anastomosis was done. An incision was made over Scarpa's triangle on the left leg and carried down to the vessels. The vein and artery were dissected free for about three inches. A Crile clamp was placed on the artery below the origin of the profunda and the artery was ligated with catgut as far down as possible. A Crile clamp was then placed on the vein as low down in its course as it was possible and a catgut ligature about its upper portion. The vessels were then divided. Although the outside of the artery had appeared normal with no areas of arteriosclerosis, the lumen was found to lie eccentric and to be about half its proper size with the walls thickened by soft tissue. An arteriovenous anastomosis was then done connecting the upper end of the artery with the lower end of the vein. Fine silk sutures on fine sewing needles were used, the walls of the vessels being turned so that intima came in contact with intima according to Carrel's method. When the suture was complete the clamp was removed from the vein and then the artery. There was some bleeding at the suture line which was controlled by two additional sutures. The blood current then passed through the joint, the vein filled out and the pulsations could be felt below the anastomosis. During the placing of the sutures the lumen of the vessel had been frequently washed out with salt solution in a medicine dropper. The soft tissues and fascia were then sutured over the site of the anastomosis and the skin incision was closed. A spica bandage was applied holding the thigh flexed on the body, and as soon as the patient was in bed, pillows were placed under the knee.

Immediately after the operation the lower half of the leg was cold and the upper half warm, a definite line separating the two areas. This line of demarcation gradually went down the leg till on March 27 the toes alone were cool. At this

time a definite oedema of the lower part of the foot had appeared.

By April 5 the foot was warm and comfortable and the patient up in a wheel chair. The superficial slough at this time was removed from the original area of gangrene over the heel, leaving a firm, dry, fibrous tissue base with an edge which bled somewhat. At about this time a bleb appeared over the dorsum of the big toe and some over the patella. These were pricked and dusted with powder and never showed any tendency to spread, though a discolored area persisted.

On April 26 it was noticed that without any apparent reason the whole leg had become decidedly oedematous. From this time there was no very marked change in the local condition except that a cool area about three inches wide encircling the middle of the leg appeared while the foot and upper leg remained warm. The sloughs on the heel and over the big toe began very gradually to extend and a bed-sore which had developed over the sacrum showed no improvement. The general condition of the patient became gradually poorer and she gradually failed and died from senility on May 26.

In review, the important features of the case are these: A foot previously cool is rendered warm and slightly oedematous by an arteriovenous anastomosis. The original area of necrosis remained latent after the operation, where as before it was said to have been growing rapidly, and its edge began to bleed. This condition continued till the general condition of the patient failed, when the area began to increase in size. Clinically, then, a very decided immediate change followed the operation and was therefore probably caused by it.

An examination of the local conditions after death was allowed and the pathological report by Dr. Lawrence J. Rhea follows:

Autopsy May 27, 1908.—On the left heel there is an ulcerated, depressed area about 3 cm. in diameter. The tissues immediately about it are considerably discolored. There is an area of sharply demarcated gangrene involving the great toe. On the inner side of the knee on the left side

there is a sharply outlined, punched out ulcer 4 cm. in diameter and about 5 mm. deep. The subcutaneous tissue has entirely disappeared. The underlying muscles are distinctly visible and show some necrosis.

In the inner border of Scarpa's triangle on the left side there is a linear scar running down in the direction of the leg, measuring 8 cm. long. An incision is made from Poupart's ligament down through the central portion of Scarpa's triangle, the skin and subcutaneous tissue are dissected back and the femoral artery and vein exposed. These two vessels are carefully removed. At their upper end they are cut across as high up as possible, just a little above Poupart's ligament. The lower extremities are cut about half way down the leg. The tissues attached to this artery and vein are carefully dissected away and the artery and vein laid open. The upper portion of the femoral vein ends blindly a short distance below the profunda vein. In this same region the lower end of the femoral artery ends as a blind sac. In both the lower end of the artery and upper end of the vein the lumen was occluded by a light gray, rather elastic tissue which is slightly adherent to the vessel wall. (Thrombi which are undergoing organization.) The lumen of the upper end of the femoral artery is continuous with the lower end of the femoral vein. The point of union of the lumens of these two vessels is quite distinct and is marked by a band of thickened, dense scar-tissue. Immediately below this point of union there are seen a set of normal valves upon the vein. Both the artery and vein in the region of their point of union contain a pale elastic tissue which is quite firmly adherent to the vessel wall. This material (thrombi) would seem to have, at least for the most part, occluded the lumen of the vessel. The femoral artery is thickened throughout, the portion examined has practically lost its elasticity and shows several areas of calcification. The lower end of the artery, which has been tied off, is thicker than the upper end, its lumen being greatly infringed upon.

Remarks.—The artery shows marked arteriosclerosis.

Its lumen is quite markedly narrowed. This narrowing seems to be more marked, comparatively, below the profunda artery than above it. The upper end of the femoral vein and its branches are occluded by a thrombus which is undergoing organization. The lower end of the femoral artery contains a thrombus which is being organized. The point of union between the upper end of the femoral artery and the lower end of the femoral vein seems to have entirely healed, scar-tissue being deposited. The thrombus found at this point of union and extending into both the artery and vein shows some organization. Since these vessels are already diseased and the patient is old and her recuperative properties greatly decreased, it is difficult to tell how long this thrombus has been forming.

Had no post-mortem examination been allowed I should have considered the operation to have been a success. Now, however, the age of the thrombi in the vessels is the determining point as to the success or failure of the anastomosis. If the thrombus at the anastomosis formed soon after the operation and is equally old with those in the ligated vessels then the operation was a failure. If, however, it formed later due to the failing strength of the patient at a time when clinically a sudden and marked oedema appeared in the leg then it is fair to consider that the operation had been a success. When the pathologists cannot determine the relative age of thrombi who is to decide?

Of the three cases of arteriovenous anastomosis done by me for senile gangrene the first was reported in the *ANNALS OF SURGERY* for October, 1906. The patient was seen in May, 1908, and the amputation stump was found well nourished. (Amputation was done at the point of election on the tibia for gangrene of the foot existing previous to the anastomosis.) The second case was a failure in that a clot formed immediately at the site of the anastomosis. The success or failure of this the third case is not determined.

As I have watched the reports of cases of arteriovenous anastomosis and as my own ideas have become crystalized

from the observation of these cases, I feel that so far nothing very brilliant has been accomplished. I shall nevertheless continue to suggest this treatment in appropriate cases since the operation is free from all shock and can do no harm other than necessitate, if it fail, a second etherization for an amputation.